CLAIMS

We claim:

1. A method for producing a model of a region of interest, the method comprising:

collecting a first set of data points pertaining to the region of interest;

dividing the first data set into a second data set and a third data set;

populating a model with data points from the second data set;

interpolating a data point in the model using a subset of data points from the second data set;

comparing a subset of data points in the model to a subset of data points in the third data set; and

if comparing yields a discrepancy larger than an error limit, then varying a data point in the model corresponding to a data point in the second data set and repeating the interpolating and comparing.

2. The method of claim 1 wherein collecting comprises collecting data points of more than one type.

3. The method of claim 1 wherein dividing produces data points common to the second and third data sets.

4. The method of claim 1 wherein interpolating comprises applying multi-dimensional, finite-element methods to a subset of data points in the model.

5. The method of claim 1 wherein interpolating comprises applying an equation to a subset of data points in the model, the equation being of a type in the set: thermodynamic, chemical, genomic.

6. The method of claim 1 wherein interpolating is based, at least in part, on a spacing among a subset of data points in the model.

7. The method of claim 1 wherein comparing yields a discrepancy based, at least in part, on a sum of squares of differences between a subset of data points in the model and a subset of data points in the third data set.

8. The method of claim 1 wherein varying a data point comprises varying an item in the set: a value of the data point, a position of the data point in the model.

9. The method of claim 1 wherein varying comprising varying multiple data points in the model corresponding to data points in the second data set.

10. The method of claim 1 wherein collecting comprises associating measures of constraint with data points in the second data set and wherein varying comprises choosing a data point in the model to vary, the chosen data point's measure of constraint being less than that of another data point in the model.

11. The method of claim 10 wherein a measure of constraint is associated with a probable error range and wherein a larger error range yields a lower constraint.

12. The method of claim 10 wherein interpolating is based, at least in part, on measures of constraint of a subset of data points in the model.

13. The method of claim 1 further comprising:

estimating a probability of the model resulting from the varying;

wherein the varying comprises choosing an amount by which to vary a data point, the data point and the amount to vary the data point chosen, at least in part, in order to maximize an estimated probability of the model.

14. The method of claim 13 wherein estimating a probability is subject to a constraint based on a subset of data points in the third data set.

15. The method of claim 13 wherein estimating a probability comprises:

calculating a probability functional that maximizes an entropy, the calculating subject to normalizing the probability functional and subject to a constraint based on a subset of data points in the third data set.

16. The method of claim 15 wherein entropy is defined to comprise a negative of a functional integral over possible states of the model of the probability functional multiplied by a natural log of the probability functional.

17. The method of claim 15 wherein normalizing the probability functional comprises setting a functional integral over possible states of the model of the probability functional to one.

18. The method of claim 15 wherein the calculating is subject to a constraint based on a subset of data points in the third data set when a functional integral over possible states of the model of the discrepancy multiplied by the probability functional is equal to an ensemble error average.

19. The method of claim 15 wherein maximizing an estimated probability of the model comprises:

determining where a functional derivative of the probability functional with respect to the model becomes zero.

20. A computer-readable medium having instructions for performing the method of claim 1.

21. A method of extending a model of a region of interest along a coordinate, the method comprising:

applying an equation to evolve the model a distance along the coordinate; and

maximizing a probable state of the evolved model.

22. The method of claim 21 wherein maximizing a probable state comprises:

collecting a set of data points pertaining to the region of interest;

comparing a subset of data points in the model to a subset of data points in the collected data set; and

if comparing yields a discrepancy larger than an error limit, then varying a data point in the model and repeating the comparing.

23. The method of claim 22 wherein comparing comprises comparing data points of more than one type.

24. The method of claim 22 wherein comparing yields a discrepancy based, at least in part, on a sum of squares of differences between a subset of data points in the model and a subset of data points in the collected data set.

25. The method of claim 22 wherein varying a data point comprises varying an item in the set: a value of the data point, a position of the data point in the model.

26. The method of claim 22 wherein varying comprising varying multiple data points in the model.

27. The method of claim 22 further comprising:

estimating a probability of the model resulting from the varying;

wherein the varying comprises choosing an amount by which to vary a data point, the data point and the amount to vary the data point chosen, at least in part, to maximize an estimated probability of the model.

28. The method of claim 27 wherein estimating a probability is subject to a constraint based on a subset of data points in the collected data set.

29. The method of claim 27 wherein estimating a probability comprises:

calculating a probability functional that maximizes an entropy, the calculating subject to normalizing the probability functional and subject to a constraint based on a subset of data points in the collected data set.

30. The method of claim 29 wherein entropy is defined to comprise a negative of a functional integral over possible states of the model of the probability functional multiplied by a natural log of the probability functional.

31. The method of claim 29 wherein normalizing the probability functional comprises setting a functional integral over possible states of the model of the probability functional to one.

32. The method of claim 29 wherein the calculating is subject to a constraint based on a subset of data points in the collected data set when a functional integral over possible states of the model of the discrepancy multiplied by the probability functional is equal to an ensemble error average.

33. The method of claim 29 wherein maximizing an estimated probability of the model comprises:

determining where a functional derivative of the probability functional with respect to the model becomes zero.

34. The method of claim 21 wherein the model is evolved along a coordinate in the set: time, space.

35. The method of claim 21 wherein applying an equation comprises applying an equation to a subset of data points in the model, the equation being of a type in the set: thermodynamic, chemical, genomic.

36. A computer-readable medium having instructions for performing the method of claim 21.

37. A method of estimating a probability of a model of a region of interest, the method comprising:

collecting a set of data points pertaining to the region of interest;

comparing a subset of data points in the model to a subset of data points in the collected data set to yield a discrepancy; and

calculating a probability functional that maximizes an entropy, the calculating subject to normalizing the probability functional and subject to a constraint based on a subset of data points in the collected data set.

38. The method of claim 37 wherein comparing comprises comparing data points of more than one type.

39. The method of claim 37 wherein comparing yields a discrepancy based, at least in part, on a sum of squares of differences between a subset of data points in the model and a subset of data points in the collected data set.

40. The method of claim 37 wherein entropy is defined to comprise a negative of a functional integral over possible states of the model of the probability functional multiplied by a natural log of the probability functional.

41. The method of claim 37 wherein normalizing the probability functional comprises setting a functional integral over possible states of the model of the probability functional to one.

42. The method of claim 37 wherein the calculating is subject to a constraint based on a subset of data points in the collected data set when a functional integral over possible states of the model of the discrepancy multiplied by the probability functional is equal to an ensemble error average.

43. A computer-readable medium having instructions for performing the method of claim 37.

44. A method for producing a model of fracture locations and fracture characteristics in a geologic basin, the method comprising:

collecting a first set of data points pertaining to the geologic basin;

dividing the first data set into a second data set and a third data set;

populating a model with data points from the second data set;

processing a subset of data points in the model by applying equations to simulate rock rheology by integrating continuous deformation with fracture, fault, gouge, and pressure solutions;

processing a subset of data points in the model by applying equations to simulate mechanical processes to coevolve deformation with multi-phase flow, petroleum generation, mineral reactions, and heat transfer;

comparing a subset of data points in the model to a subset of data points in the third data set; and

if comparing yields a discrepancy larger than an error limit, then varying a data point in the model corresponding to a data point in the second data set and repeating the processing and comparing.

45. The method of claim 44 wherein collecting a first set of data points comprises collecting data in the set: well log data, surface data, core data, seismic data.

46. A computer-readable medium having instructions for performing the method of claim 44.

47. A method for producing a model of a biological cell, the method comprising:

collecting a first set of data points pertaining to the biological cell;

dividing the first data set into a second data set and a third data set;

populating a model with data points from the second data set;

processing a subset of data points in the model by applying equations to simulate reactions, the equations being of types in the set: chemical kinetic, proteomic, genomic, glycolysis, citric acid cycle, amino acid synthesis, nucleotide synthesis, membrane transport;

comparing a subset of data points in the model to a subset of data points in the third data set; and

if comparing yields a discrepancy larger than an error limit, then varying a data point in the model corresponding to a data point in the second data set and repeating the processing and comparing.

48. The method of claim 47 wherein collecting a first set of data points comprises collecting data in the set: microscopy, genomics, proteomics, multi-dimensional spectroscopy, x-ray crystallography, thermodynamics, biochemical kinetics, bioelectrics.

49. A computer-readable medium having instructions for performing the method of claim 47.